Smallholder compliance with private standard certification: the case of GlobalGAP adoption by mango producers in Peru

Abstract

The prevalence of food quality standards in international trade is constantly increasing and has a growing influence on developing countries. A wide range of literature in development economics has focused on the debate of whether international standards exclude small-scale farmers from high-value food markets. In fact, the evidence is mixed. New debates arise on what conditions small farmers can really comply with, pointing out both threshold capital requirements, on the one hand, and industry structure and institutional environment, on the other hand. Drawing on a microeconomic approach, our paper is a contribution to the literature exploring the patterns and determinants of smallholders' adoption of the food standard. We focus our case study on GlobalGAP adoption by small-scale fresh mango producers in Peru. Based on an analysis of primary data collected on the Peruvian mango sector, we show empirically that a few smallholders are engaged in GlobalGAP certification for a maximum of 3 years. They comply with the standard thanks to the support of exporting companies. Exporters offer the farmers contract farming, which includes technical advice and the annual certification cost. Nonetheless, farmers who are integrating into this high value-added supply chain seem to be selected on the basis of their proximity to the exporter plant (reducing transaction costs) and their ability to become reliable suppliers over the long term (experienced, specialized, and used to respecting contracts). These farms also must demonstrate their ability to deliver with short lead times (presence of mobile phone, distance to the plant). Finally, the paper underlines the key role of exporters in Peru as intermediaries and organizers in the way smallholders may participate in private standards in agrifood value chains.

Key words: *GlobalGAP, adoption, small-scale farmer, mango, Peru*

Author's acknowledgements: This paper was made possible through the support provided by the EU NTM-Impact Project (www.ntm-impact.eu). The data and qualitative details were collected in Peru in collaboration with AVSF Peru. Thanks to Cesar Paz for helpful field work coordination.

1. Introduction

The last two decades witnessed unprecedented changes in the agro-food sector through the proliferation of standards in international agricultural trade. After a period during which the states of developed countries actively implemented food safety standards (this has been exacerbated by a series of food scandals (Henson and Caswell, 1999)), private food standards have rapidly penetrated agro-food markets as well nowadays. Expanding beyond their initial tiny market niche, they attend to rising consumer concerns regarding the conditions of production and trade of the goods they buy (Jaffee and Henson, 2004). These voluntary standards combine a mixture of food safety, environmental, and social dimensions, while an inherent emphasis is being given to product traceability. Consequently, standards not only affect the safety of final products, but also the whole organization of the supply chain (Hammoudi et al., 2009). This significant change raises new opportunities and challenges for small export-oriented farmers in developing countries and has implications for agricultural development programs and policies.

The pattern of new standard adoption in developing countries has recently received much attention from economists. A wide range of empirical literature argues that standards may act as a barrier to market access for smallholders: the stringent conditions tend to lead to the exclusion of smallholders and the inclusion of larger farmers (Augier et al., 2005; Dolan and Humphrey, 2000; Escobal et al., 2000; Fuchs et al., 2011; Key and Runsten, 1999; Reardon et al., 2003; VanDerMeer, 2006). In fact, compliance with standards often requires considerable human, physical, financial, informational, and network resources. Lack of access to these resources and the certification costs are the most common factors explaining the non-compliance of smallholders with standards (Busch and Bain, 2004; Vorley and Fox, 2004). On the contrary, some less pessimistic studies find positive effects, arguing that standards can be a catalyst for upgrade by improving farming techniques and product quality, thereby allowing them to participate in high-value added chains (Lee et al., 2010). Smallholders may be included in the high-standard market thanks to a contract-basis with the agro-exporters (Asfaw et al., 2010; Chemnitz, 2007a; Chemnitz et al., 2007b; Henson et al., 2011; Maertens and Swinnen, 2009; Minten et al., 2009). Finally, it is becoming generally recognized that evidence is mixed. New debates arise over the degree to which compliance processes do indeed act to exclude smallholders (Henson and Humphrey, 2009) and with which conditions small farmers can really comply, pointing out both threshold capital requirements one the one hand and industry structure and institutional environment on the other hand that may greatly affect standard adoption by smallholders (Chemnitz et al., 2007b; Lee et al., 2010).

In this paper, we focus on GlobalGAP adoption by small-scale producers of fresh mangos in Peru. The fresh mango sector in Peru is an interesting case, as the private GlobalGAP standard – the most important standard that applies to the production of fresh mangos – has become quasi-mandatory for exportation to the European Union (EU) since 2007. Yet two-thirds of mangos are exported to the EU. Kleinwechter and Grethe (2006) have previously studied the adoption of the EurepGap standard in the mango export sector in Peru in 2004-2005 (Kleinwechter and Grethe, 2006). They have shown that the first major barrier to adoption is linked to accessing information about the standard. Since exporting enterprises were the most informed actors, the adoption of the standard is mostly found in their activities via vertical integration. According to the results of Kleinwechter and Grethe (2006), small-scale producers did not comply with EurepGap certification in 2004-2005. Our research seven years later shows evidence that nowadays a slight percentage of smallholders comply with GlobalGap as well. Surveys were conducted with 228 small-scale mango producers from October 2010 to July 2011. Data was collected in the region of Piura, the main zone of mango

production. Findings show that the standard adopters comply with the standard thanks to the support of exporting companies through farming contracts, technical advice, and by paying the annual certification costs. These kinds of farming contract with smallholders have been described in others cases (Asfaw et al., 2007; Jaffee and Henson, 2004; Minten et al., 2009). This support allows small-scale producers to be included in the lucrative international market.

Our paper is a contribution to the literature exploring the patterns and determinants of the food standard adoption. More generally, our case study underlines that understanding the role of intermediaries is essential to understanding the upstream decision to adopt private standards. Nonetheless, since the adoption of the standard by smallholders is very recent, it was not possible to measure the differential effect of the adoption on production or price of mangos.

The paper proceeds as follows: section 2 provides a background of mango production and trade in Peru and the evolving international trade towards standards; section 3 develops the empirical model and estimation strategy; section 4 describes the survey and data; section 5 presents and discusses the empirical findings; and section 6 concludes the paper.

2. Fresh mango sector in Peru

a) Production and Trade

According to the World Bank definition, Peru is a low middle income country with a GDP of USD 152.8 billion and per capita income of USD 9200 in 2010 (Worldfactbook, 2010). In Peru, agriculture is still a source of economic development. It accounts for 8% of the GDP and provides 23% of direct and indirect employment (INEI, 2008). Fresh mango is one of the major agricultural exports. Since 1985 with the first export towards the US, the sector has grown at remarkable rates. Between 2000 and 2010, the cultivated areas passed from nearly 18700 hectares to around 28400 hectares and the production from 125 thousand tons to 250 thousand tons (MINAG, 2010). Peru exports around 30% of its national production (105,724 tons in 2009/2010) and is the fifth largest mango exporter in the world. Fresh mangos are by far the most important of exported mangos (87% of exported mango volumes in 2009, according to customs). Exports go to both the EU (65%) and US (35%) markets, but it is only since 2006 that the EU has surpassed the US as the main destination market (Appendix 1 and Appendix 2) (Gerbaud, 2010).

Production is concentrated in northern Peru, in the region of Piura (around 70% of the national production and 90% of exported production). The main mango varieties grown for the domestic market are the local variety Criollo, and the improved variety Edward. Nevertheless, their productions have declined. Improved varieties for export such as Kent (94.5% of export volumes) have steadily replaced the domestic ones (SENASA, 2010). Piura export-oriented production is harvested between November and March. At this period and for the EU market, Peru – the second largest supplier – competes with Brazil in November and December. (Gerbaud, 2010).

The monthly FOB prices for exportation to the EU and to the US are nearly similar for both markets (Appendix 3). Nevertheless, there are some monthly or annual variations due to the other competitors for the targeted market (for instance, the EU market price was higher than the US price in November 2010 because of the shortage of Brazilian mangos on the international market, which was not the case in November 2009 (Gerbaud, 2010). Otherwise,

Kent variety prices are substantially lower than those for the Edward or Criollo varieties on the domestic market, as Peruvian consumers do not value the taste of the latter. The domestic market alternative for Kent mangos is thus not profitable.

For Kent mango producers, the international market is thus the only lucrative market. Nonetheless, the first constraint to accessing an outside market is related to the minimum volume required by the buyer (at least one container, i.e. 20 tons). This explains why small-scale producers (on average hardly producing 20 exportable tons) cannot export directly and work with exporters or form producer associations in order to get export market access.

b) Non-tariff measures from the EU market

For both the EU and the US markets, exports are required to respect the Codex Alimentarius and maximum pesticide residual levels (MRL). Nevertheless, contrary to the US, Europe does not require hydrothermal treatments to kill fruit flies[1]. Mangos exported to Europe are cleaned and then packed in 20 existing packing plants located in the Piura region. Barriers to trade in the EU are therefore much more relative to private standards: at the plant level, the HACCP is essential; at the production level, GlobalGap has become almost mandatory since 2007, and organic certification has spread. Indeed, while European Retail Produce Good agricultural Practices (EurepGAP) was developed by 13 European retailers, the Global Good agricultural Practices (GlobalGAP) begin to have an expanding role as one of the major private standards in the international trade (Lee et al., 2010).

As Chemnitz et al., (2007b) argue in their paper, the nature of the standard – namely the annual compliance cost, but also the type of capital required – may affect producers differently. The GlobalGap guideline ensures good agricultural practices focusing first on food-safety, but also a number of issues concerning environment quality (soil, water, and wildlife conservation), worker safety and hygiene, and traceability on the farm. The certificate includes some initial investments (such as toilets, canteens for workers, water taps, safety equipment, and storage facilities for agricultural inputs and outputs, respectively) that require substantial financial capital to upgrade the farm. It also entails annual costs for external inspection by a certification body. Finally, it requires that the producer know how to read, write, and keep records – which means a high level of human capital. Producers have two options to obtain certification under the standard: they can apply individually or apply collectively for a producer group certificate.

In Peru, information on the GlobalGap standard is relayed by government organizations, producer and exporter organizations, and NGOs. Concerning the cost of compliance, our interview results highlight a large variability of the compliance costs, ranging between 150 and 833 US$/ha[2]. This is influenced by the previous endowments in storage or other infrastructures and the technical level of the farm, but also by its size (since required infrastructure and technical levels are not size proportional). Some added costs are then spending for infrastructure maintenance. According to the producers' perceptions in Peru, implementation costs remain the major constraint from GlobalGap standard implementation. In addition, the fixed cost of annual inspection in Peru is 2000 $US/year. This is high, all the more so without a premium in the product price. The size of an individual enterprise is thus a

[1] The most demanding norm for exportation to the US relates to a public norm that requires a hydrothermal treatment to kill fruit flies; the mangos undergo a hot water treatment in a certified processing plant.

[2] In spite of a large variability in their results, Kleinwechter and Grethe (2006) calculate a compliance cost of 145 US$/ha/year on average and 9.51 US$/ton/year, i.e. 3.8% of the mango farm gate price.

major determinant of standard adoption. According to our first qualitative interviews, the minimum profitable size to individually implement GlobalGAP is around 20 ha.

c) Export-oriented stakeholders

In Peru, most of the mango producers are smallholders (i.e. 85% of them have less than 20 ha of total land including 15% who have less than 5 ha). This repartition and the rather small size of mango producers in Peru are due to the agrarian reform of 1969.

In 2009, 1,627 producers exported their mangos. Among these producers, 75% are smallholders (less than 20 ha of total land), 20% are medium farmers (from 20 to 50 ha), and 5% are large-scale farmers (more than 50 ha). They account for 30%, 30%, and 40% of exported produce, respectively. Larger farmers are generally vertically integrated into exporter enterprises and thus export their own mango production. However, there is large variability in mango production from year to year[3]. Thus, they generally complete their own production by purchasing from smaller farmers. Suzuki et al. (2011) also note, in their case study on pineapple exporters in Ghana, that this strategy is undertaken, at least in part, to shift quantity risks (Suzuki et al., 2011). Small-scale producers may thus have annual contracts (written or oral contracts, but hardly enforceable). Through these contracts, they steadily delegate harvests to the exporter (or a third party assigned to harvest on behalf of the packing plant), since it becomes very difficult to gather daily workers. In addition, in many cases, producers hardly have any access to credit to pay workers. A disadvantage of that service is the high level of mangos discarded during the harvest – the discarded mango rate is on average 20%. Exporters are also in charge of carrying out transportation to the processing plant. Prices are rarely fixed and pay is often delayed. Nonetheless, for a monthly adjustment strategy, exporters do not implement farming contracts with smallholders.

In 2009-2010, there were 106 fresh mango-exporting companies (SENASA, 2010). There is a rather medium concentration of exports in few exporting companies: the top 10 represent 46% of the total export volume. However, when compared to the figures from 2005-2006 (Fulponi, 2007), this concentration in the mango-exporting sector has decreased these last five years, revealing a still very attractive and expandable market: in 2005 there were around 70 mango exporters in Peru and the top 6 represented 54%; Moreover the top 1 accounted in 2006 for 22.1% of the total fresh mango export and in 2010 only for 10.2%. Otherwise, there are still few foreign exporter enterprises (it seems there are only two for the moment) but since the sector has been attractive for foreign investments few years ago, we found Peruvian enterprises with a part of foreign capital (from the US, Colombia, Costa Rica, etc.).

Large exporters mostly rely on their own production (from 50 to 250 ha) and still tend towards increased vertical integration, even though land has become very expensive nowadays. Escobal et al. (2000) found the same dynamic in the asparagus industry in Peru ten years ago (Escobal et al., 2000). They are generally targeting both the EU and US markets. They have easily enforced quality, traceability, and certified production – in particular GlobalGAP. They own packing or treatment plants. Nonetheless, the sector shows a relatively low entry barrier since the concentration in the mango-exporting sector has decreased these last five years and the sector actors complain about the high number of small and very volatile exporter firms (60% treat less than 500 tons per year) that enter the market for short run market opportunities. These sporadic exporters are called "*golondrinos*" (meaning "swallows"). These firms are subjected to the most border rejections.

[3] For example, the 2008-2009 season was disastrous in terms of production (due to agronomic reasons). Numerous producers mention a reduction of around 50% of their production level.

The mango-producing sector is little organized in Peru. According to an expert, this could be explained by the fact that there are lots of small producers and the mango season is very short, around 3 months.

3. Empirical model and estimation strategy

In our paper, we question the determinants of the adoption of GlobalGap by small-scale farmers. The requirement of GlobalGAP standard is here modeled as a shock to the EU export supply system, which has shown a continuous dynamic since 2000. As Chemnitz *et al.*, (2007) and Henson and Jaffee (2008) have already highlighted, the ability to comply with standards will depend on several factors at the country, market, and firm levels, as well as the specific food standards. Here, we have taken an essentially microeconomic approach, focusing on the determinants of farmer standard adoption at the farm level. We have characterized the country, the market, and the specificity of the GlobalGAP standard as an element of context in the section above. In this given context, we want to assess how farm characteristics determine farmers' compliance with the GlobalGAP standard. We thus model the farmers' decision whether or not to comply with the GlobalGAP standard as a standard static adoption decision, where adoption is determined by the incentives for and capabilities of farmers (Feder et al., 1985).

In regards to incentives, the GlobalGAP standard may offer farmers more demand reliability in terms of volume and/or allow higher prices. In our case study, the incentives are in part implicit to standard adoption and are further determined by farm characteristics themselves (size, bargaining power, etc.). Therefore these factors will not be directly entered into the implementation model. In regards to capabilities, meeting the GlobalGAP standard requirement may imply the presence of or the investment in some physical as well as human capital. The GlobalGAP standard requirement is therefore hypothesized as determining a threshold capital requirement, which suppliers must have in order to benefit from the standard opportunity. This threshold capital requirement may include physical capital (e.g. land, vehicles), human capital (e.g. age, education, business experience), financial capital (e.g. access to credit) and social and organizational capital (e.g. group membership). Farmers with capital above this threshold capital requirement are expected to adopt the GlobalGAP standard if the incentives are there to continue to export for the EU market. Farmers with capital below this threshold capital requirement would be excluded from the GlobalGAP standard adoption and thus from the EU export chain.

We can refer to a conceptual reduced-form model defining standard adoption as follows:

$\forall i$, we consider:

$$GlobalGAP_i = \beta X_i + \varepsilon_i$$

GlobalGAP is a binary variable equal to 1 if the farmer $_i$ adopts the standard (and zero otherwise). X_i is a set of observed variables influencing the decision to adopt the GlobalGAP standard; other unobserved factors are summarized by the random variable ε_i.

For the estimation, we used lagged independent variables referring to the farm capital before the decision to adopt GlobalGAP or not (we used variables from 2006 since GlobalGAP has been become almost mandatory to export to the EU since 2007). These lagged independent variables are used to control whether the standard adoption is due to an initial threshold capital. In addition, we use variables referring to the farmer relationships to other agents of the marketing channels.

First, we assume that the standard adoption will mainly be determined by the farm's capital, which represents internal farm resources and access to external resources.

To capture the influence of human capital, we include the general household characteristics such as:

- Education level above primary school: A low level of human capital, in particular management ability, is found in empirical studies as an obstacle to the implementation of high standards (Reardon and Timmer, 2007). Yet, the GlobalGAP standard requires farmers to keep in-depth records of all their practices on the farm; we thus expect that more educated farmers are more likely to adopt the standard.
- Experience as a farmer: the GlobalGAP standard requires high level of food safety and quality; it is hypothesized that the individual farmer experience may facilitate the adoption of the standard. We test the experience squared as well, because we expect that older farmers (more experienced) won't, on contrary, invest in new practices for mango production.

Moreover, we take the physical capital into account by introducing farm characteristics such as:

- Land under Kent mango in 2006: Henson and Humphrey (2009) and Barrett et al (2011) argue that some stallholder-specific fixed costs of standard certification tends to cost small farmers more than their larger peers with economies of scale and lower transaction costs. Therefore, we expect that farmers with large area of Kent mango in 2006 are more likely to adopt the standard. Moreover they have a high incentive to adopt GlobalGAP in order to maintain their access to the EU outlet for their high amount of mangos.
- Specialization of mango production in 2006 (i.e. land under mango compared to total farm land area): Again, we expect that farmers who are more specialized in mango production in 2006, meaning that they are more dependent on mango revenue, are more likely to adopt the standard in order to maintain their access to the EU outlet.
- Age of the production trees under 10 years: quantity and quality of mangos depend of the age of the trees. We introduce this variable, which could be seen as a fixed investment, since we suppose a potential effect on GlobalGAP adoption.
- Owning a mobile phone in 2006: As mango harvests are delegated to the exporter, a high level of coordination and communication is needed, we suppose that farmers with mobile phones in 2006 are more likely to adopt GlobalGAP.
- Owning a car in 2006: Farmers don't have to transport mangos, nonetheless this variable should be interpreted as a proxy for the high level of the farm capital and the farmer's wealth. Yet the GlobalGAP standard requires substantial financial capital to upgrade the farm. We suppose that wealthy farmers are more able to make initial

investments and to pay GlobalGAP certification – with the risks included (if there is no return on investment) – than others.

We also integrate variables describing the organizational and social capital such as:

- Belonging to a producer organization: As we mentioned in the last section, producers have two options to obtain certification under the standard: either by applying individually or by applying collectively for a producer group certificate. In the case of small farmers who hold less than 20 ha, the standard adoption at the individual level seems difficult due to the fixed costs of compliance. The other option is thus that farmers organize themselves within producer organizations so as to comply collectively with standards. Moreover, forming producer groups may reduce costs at various levels (lower cost for external inspection, shared investments, etc.) (Asfaw et al., 2010; Belton et al., 2011; Narrod et al., 2009). One could expect more positive results from GlobalGAP adoption when farmers belong to producer organizations.

- Being used to having contracts in 2006: annual contract reveals confidence between producer and exporter. Since standard compliance often leads to stronger vertical coordination through farming contracts (Asfaw et al., 2010; Chemnitz, 2007a; Chemnitz et al., 2007b; Henson et al., 2011; Maertens and Swinnen, 2009; Minten et al., 2009). We expect that the farmers used to having contract before 2006 are more likely to enter in this kind of relationship and adopt GlobalGAP.

Second, we assume that some variables referring to the market access will also determine standard adoption, such as:

- Distance to the plant: we suppose that farmers located far from the exporter plant are less likely to adopt GlobalGAP because they bear high levels of transaction costs (less information, less confidence in the exporter, etc.). Literature underlines irregular market access (due to insufficient infrastructures or coordination problems) as a major obstacle to participating in the competitive market (Barrett et al., 2011; Fafchamps et al., 2007).

Each of these explanatory variables is hypothesized to *ceteris paribus* influence the probability of standard adoption. We then estimate a probit regression model to test the hypothesis concerning the determinants of the adoption decision model defined above.

4. Data and descriptive statistics

a) Survey and data

This empirical study was led in the framework of the EU NTM-Impact Project (www.ntm-impact.eu), whose objectives include the analysis of the impacts of non-tariff measures (NTMs) from high-income countries – governmental regulations and private standards – on developing countries.

Between October 2010 and May 2011, we undertook a survey of 213 mango producers in the main mango region of Piura, where over 90% of exported mangos originate. We focus our analysis here on small farmers with less than 20 ha and who represent 20-30% of mango exports and 70-80% of all mango producers. We randomly selected 19 villages located in Piura region where exporters' plants are found. Within these villages, producer surveys were

chosen randomly among the farmers growing Kent mangos (i.e. export-oriented) with holdings of less than 20 ha (i.e. small farmers for whom individual GlobalGap certification might be unprofitable). Surveys were conducted on a face-to-face basis. The data collected through the questionnaire include: household and farm general characteristics, household assets, mango production and marketing behavior, mango standard certifications (organic and GlobalGap), other activities, changes and perceptions since GlobalGap has been required by exporters. This sample of 213 farmers is representative of the total small farms in Piura. Following this first wave of surveys, we inventoried 8% of the sample (18 observations), which has adopted the GlobalGAP standard. To investigate the determinants of the GlobalGAP adoption, we chose to increase the sample of standard adopters. A second wave of surveys was thus conducted in the period of July 2011 among small farmers who comply with GlobalGAP. A total of 15 farmers were interviewed in this second wave. At this stage, the selection process of the whole sample (238 producers) was not random.

In addition to the farmer surveys, additional semi-structured interviews were conducted with 10 exporters and other supply chain actors (promoting agencies, state actors, leaders of producer organizations, etc.) to collect supplemental contextual data allowing better understanding of various aspects of the mango supply chain in Peru. Finally, this primary data was supplemented with price information.

b) Characteristics of farmers and marketing behaviors

Within our whole sample, the average farm size is 8 ha, 3.3 ha of which is dedicated to mango production (of which 85% is Kent mangos). All producers grow varieties for the domestic market and personal consumption (an average of 15% of their total mango crop surface). Come small-scale producers also grow lemons (39%), cereals (21%), and cocoa (6%). 80% of respondents say that mangos are the most important product grown in terms of cash flow. Some small-scale producers are also day laborers at other farms (13%) or have off-farm income (14%). On average, they have grown mangos since 1997, but most of them started after 2000, when exportation rose dramatically. Their distance from the nearest exporter plant is around 14 km.

From the first wave of surveys, i.e. a random process that led to a representative sample of small farmers in the Piura region, 31% of farmers surveyed have heard about GlobalGap certification and only 8% are GlobalGap certified. GlobalGap certified producers are scarce, as one could expect for smallholders.

Thank to the second waves of surveys, we collected data for 33 GlobalGAP adopters. In this sample of GlobalGAP adopters, the average certification date is 2009 (from 2007 to 2010). The compliance cost is US$ 2,000 per year (without any variability among respondents). The certificate is paid sometimes by the producer himself (8%), but mostly by the exporter (56%) or a producer organization (33%). 24% of the representative sample are members of a producer organization, compared to 64% in the Global adopters sample. According to Barrett et al. (2011), contractual arrangements including adoption of voluntary standards with downstream buyers are often orchestrated through farmer groups. Indeed, according to our interviews, producer organizations allow sharing transaction costs (information research, etc.), economies of scale benefits by sharing certification costs, and some physical investments (warehouse for chemical products and machines).

Initial investments (such as toilets, canteens for workers, water taps) are more often paid for by the producers (91%). 15% of farmers have used credit from rural credit banks. 76% have decided to follow training courses for GlobalGAP implementation offered by the INCAGRO Peru project (an organization supported by the Peruvian Ministry of Agriculture and the World Bank to promote innovation in agriculture and partnership between public and private initiatives).

Differences in producer characteristics according to standard adoption are shown in the table 1 below.

Table 1: Characteristics of adopters and non-adopters: summary characteristics and statistical differences.

	Non-globalGAP **(n=195)**	GlobalGAP **(n= 33)**
Farm characteristics		
Total land size	8.3	3.8***
Ratio of land size under Kent	0.52	0.77***
Volume of mangos 2009	25	21
Household characteristics		
Age	56.2	50.8*
Education level >primary	0.45	0.66**
Experience	15.72	13.72
Children (<15 years)	1.6	1.8
Market access and relation w/ buyer		
Distance to plant	13.9	7.7***
Works only w/ 1 exporter	0.71	0.88*
Has written contract	0.12	0.66***
Technical advices	0.36	0.87***
Advance payment	0.14	0.69***
Month is important for buyer	0.11	0.12
Color is important for buyer	0.64	0.54
Weight is important for buyer	0.54	0.54

Statistical significance at the 0.01 (***), 0.05 (**), and 0.1 (*) level of probability

As presented in Table 1, the average total land size of GlobalGAP adopters is significantly lower than the non-adopters. But the average size of land under Kent mango is significantly higher than their counterparts. Regarding volumes in 2009, there are no significant differences among the groups. Finally, one of the characteristics of GlobalGAP adopters is that they are more specialized in export-oriented mango production (77% of their total land area is under Kent mango production compared to 52% for the others). Household characteristics show that GlobalGAP adopters are more likely to be a little younger and more educated than non-adopters. Experience and family size do not show any difference between the two groups.

Among variables related to market access, the distance is significantly lower for standard adopters. As we know that harvests are delegated to exporters, this could suggest that standard compliance may be more the result of an exporter's decision rather than that of the farmer. Other variables related to relationships with buyers, such as contracts and advance payments, differ significantly. We find that 66% of the producers who adopt GlobalGAP rely on written contracts. Contracts and advance payments attest to close relationships with the buyers. In the case of GlobalGAP adopters, farmers are also more likely to receive technical advice from the buyer compared to the control group. Nonetheless, standard adopters' buyers are not significantly more demanding in terms of commercial quality (color and weight) than those of their counterparts. Many empirical studies describe farming contracts as a key institutional arrangement in order to support smallholder participation in private standards (Asfaw et al., 2010; Barrett et al., 2011; Jaffee and Henson, 2004; Minten et al., 2009).

5. Results and discussion

Based on maximum likelihood estimations, table 2 presents the probit estimators of the conceptual model. In our dataset, individuals adopting GlobalGAP are oversampled so that the sample mean is more than the population mean. We calculate the average marginal effects (i.e. average behavior of individuals, (Bartus, 2005)) that automatically adjust for any weight used during the estimation.

The high rate of pseudo-R^2 of the probit model indicates that there is probably a threshold level capital requirement, which farmers must have in order to adopt the GlobalGAP standard and enter in this high added-value chain.

Table 2: Regression estimation results

Dependant variable: GlobalGAP adoption	Coeff.	d*F*/d*X*
Human capital (Household characteristics)		
Education level >primary school	0.297	4.016
Experience as a farmer	0.369**	4.953
Experience as a farmer squared	-0.009*	-0.129
Physical capital (Farm characteristics)		
Land area under Kent mango in 2006	-0.037	-0.501
Specialized on Kent mango in 2006	0.736**	9.898
Mango trees between 5 and 10 years old	0.655*	9.340
Own a mobile phone in 2006	0.908***	13.524
Own a car in 2006	-0.599	-7.214
Social capital		
Belong to a producer organization	0.700**	10.352
Used to having contracts in 2006	1.058***	16.973
Financial capital		
Off-farm income in 2006	0.229	3.228
Market access		

Distance to the plant	-0.171***	-2.304
Constant	-3.735**	
Pseudo-R^2	**0.45**	
N	**201**	

Regarding human capital, we find that the number of years that the farmers have been growing mangos significantly increase the likelihood that they will adopt the standard. An extra year of experience would increase the probability of adoption by almost 5%. Better-experienced farmers might be better aware of business opportunities and seem to move quicker towards new high-level quality requirements. The effect of an extra year becomes smaller the longer the farmer does this activity, as shown by the significance of the squared term. This corroborates our hypothesis that older farmers won't invest in new practices for mango production.

Regarding physical capital, we find no evidence that having more land area under Kent mango increases the probability of adopting GlobalGAP. However, the specialization of mango production is positively correlated to the GlobalGAP adoption. This is as expected (marginal effect of almost 10%), since the farmer portfolio is reduced and these farmers are more likely to adopt standards in order to maintain their access to the EU outlet. The age of mango trees is also a determinant of GlobalGAP adoption. Trees aged 5 to 10 years have better potential in terms of mango production quality and quantity than older trees, which explains a positive effect on GlobalGAP adoption. Finally, owning a mobile phone is a strongly positively determinant to explain standard adoption (marginal effect of 13.5%), whereas owning a car is not significant. Indeed, according to the organization of the chain (farmer delegate harvest to exporters), communication appears more essential than transport facilities. Having a mobile phone is thus a critical capital requirement for farmers who want to adopt the standard.

Regarding the social capital, we find that farmers who are members of a producer organization increase significantly (marginal effect of 10.35%) their likelihood to adopt GlobalGAP than their counterparts. In addition, when farmers have been used to having contracts, they are significantly more likely to adopt the standard (marginal effect of almost 17%).

Among farm capital, access to external resources – namely financial capital through off-farm income – is not significant in predicting GlobalGAP adoption.

Finally, at the minimum, findings on the different types of capital suggest that certification is non-random and underlines the relevance of a threshold capital requirement (experience, specialization, young mangos trees, mobile phones, producer organizations) that accounts for endogenous selection.

Otherwise, we have assumed that some variables, such as distance to the plant, referring to the market access will also *ceteris paribus* determine the standard adoption. Estimation results show a strong negative correlation between the distance to the plant and the likelihood that the farmer will adopt the standard. An extra kilometer of distance to the plant would decrease the probability of adoption by 2.3%. Since it is the exporters who manage the harvest inside the mango farms and offer contract farming to small farmers for the GlobalGAP adoption, we think that the standard compliance may be more the result of an exporter's decision rather

than that of the farmer. Standard implementation may increase transaction costs and agency costs (namely *alea moral*) for exporters who will thus prefer nearby farmers. In a second stage, farmers choose whether or not to adopt the standard.

According to these findings, exporters might select their GlobalGAP suppliers on the basis of these latter's distance to the plant and ability to become reliable suppliers over the long term (experienced, specialized, and used to respecting contracts). These farmers must also demonstrate their ability to deliver with short lead times (presence of mobile phone, distance to the plant). Moreover, adopters comply with the support from exporters most of time but also with the support of producer organizations. According to Barrett et al. (2001) membership in a farmer organization is an observable signal that helps the firms identify the best prospective suppliers because of the technical support, the economies of scale, the reduced transaction costs, and the group enforcement mechanisms.

Exporters play thus a key role as intermediaries and organizers in agrifood value chains, by deciding who and how suppliers will meet buyers' sophisticated demands. These results have been described in others cases. Lee et al. (2010) argue that the influence of intermediaries on smallholders is particularly important in buyer-driven and producer-driven value chains. These cases are the more beneficial to smallholders compared to bilateral oligopolies, where traders may be more vertically integrated.

6. Conclusion

This paper is a contribution to the debates on whether international standards tend to exclude small-scale farmers from high-value food markets. Drawing on a microeconomic approach, we question the determinants of small-scale farmers' adoption of GlobalGap.

Data collected through a large number of surveys with small-scale export-oriented producers (228 surveys) shows three main results:

First, there is evidence that GlobalGAP adoption by smallholders exists, since 8% of the representative sample is complying with GlobalGap.

Second, exporting companies support these farmers in complying with the standard through farming contracts, technical advice, and by paying the annual certification costs. This support allows small-scale producers to be included in the lucrative international market. Therefore, while GlobalGap-certified exporter companies tend to increase the vertical integration of the mango production (as shown previously by Kleinwechter and Grethe, 2006), now a mixed picture of their mango supply exists thanks to contract farming, allowing the integration of small-scale farmers into the high standard market.

Third, nonetheless, farmers who are integrating into this supply chain seem to be selected according to two characteristics: they are more specialized in mango production (more than 80% of their land) and they are located closer to the exporter plant. Exporters may thus decrease transaction costs by selecting productive farmers close to their plants.

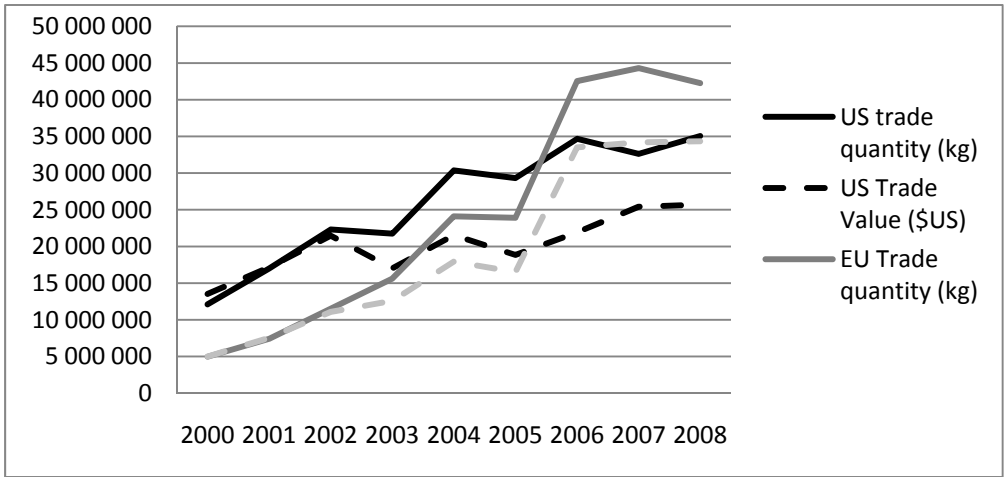
This study aimed thus to contribute to the analysis of the conditions under which small-scale farmers are more likely to comply with a voluntary food standard. The latter is of interest to policymakers since Peruvian agriculture is still source of economic development and represents a large source of employment. Adoption or not of growing international standards in different agricultural sectors is very important to analyze in order to develop adapted policy recommendations and support for farmers. However, the question is whether policymakers can do anything to facilitate the compliance of smallholders with new

sustainable standards. The success story of Kenya (Jaffee and Henson, 2004) could highlight some interesting key points, in particular with the development of the public guidelines for good agricultural practices by product and the definition of a clear direction for technical assistance and support programs for small-scale farmers.

Finally, to pursue this analysis further, it would be interesting to measure the income and poverty effects of such high-standard trade (or even labor market effects) on small-scale farmers. Nonetheless, to do that, we would need to go back to the very date of standard adoption by farmers (it requires at least a whole year to register the short-term effects on price and income). In addition, more consideration must been done to analyze how industry structure and institutional environment of a given country affect the implementation of compliance with private standards.

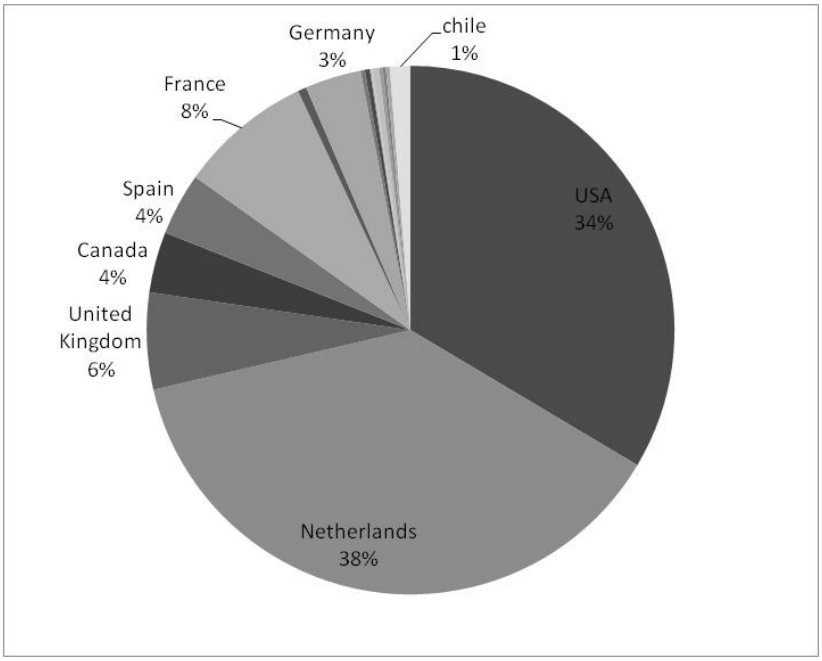
Appendixes:

Appendix 1: Evolution of Peruvian mango exports in the EU and the US (quantity and value) since 2000



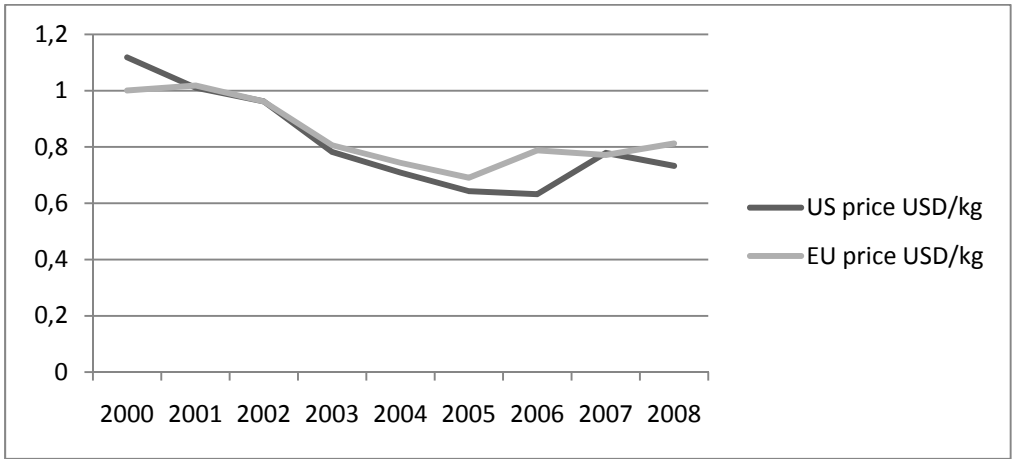
Source: COMTRADE, 2010

Appendix 2: Export of Peruvian mangos in the world in 2010



Source: SENASA, 2010

Appendix 3: Evolution of Peruvian mangoes price in EU and US since 2000



Source: COMTRADE, 2010

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